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Status: Final
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go/gtrade-marple-design

Motivated by project Poirot, project Poirot for AWBid (A.K.A Marple) aims to provide optimal bidding strategy for GDN advertisers to buy on non-second price exchanges. Some initial explorations and proposed approaches are described here.

Given a second price auction, the optimal strategy for an advertiser who has a value v for an impression is to bid $b = v$. In a non second-price auction, the price the advertiser pays depends on its bid, which means that the optimal strategy may be to bid $b' < v$. In particular, the optimal strategy would be to bid the lowest amount at which the advertiser still wins the impression

(assuming that this amount is less than the advertiser's value; otherwise the advertiser would prefer not to win).

We then adjust the advertiser's bid in order to maximize the surplus

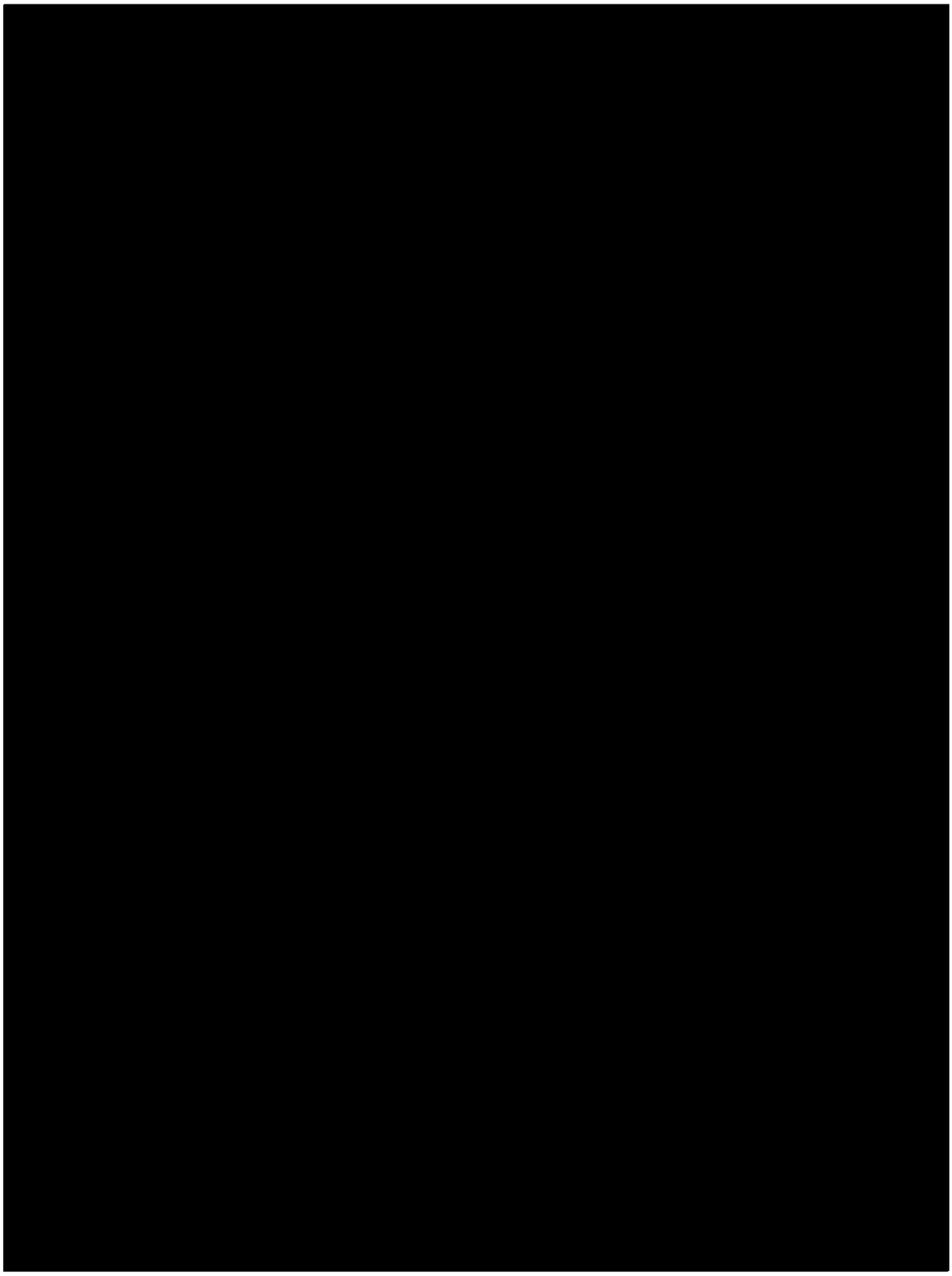
$$surplus = \sum_i \quad (v - c_i),$$

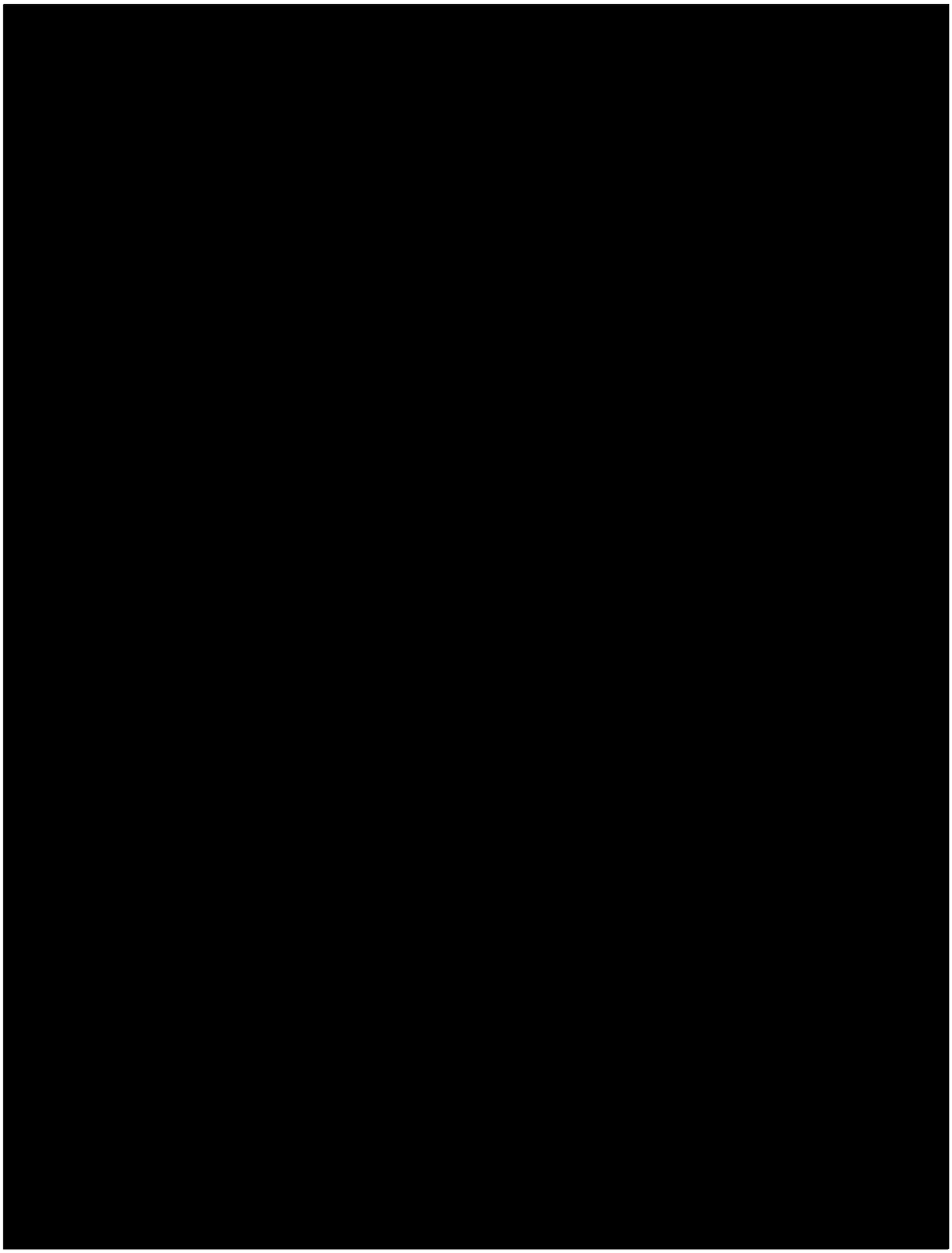
where the sum is over all won impressions and c_i is the cost of each impression.

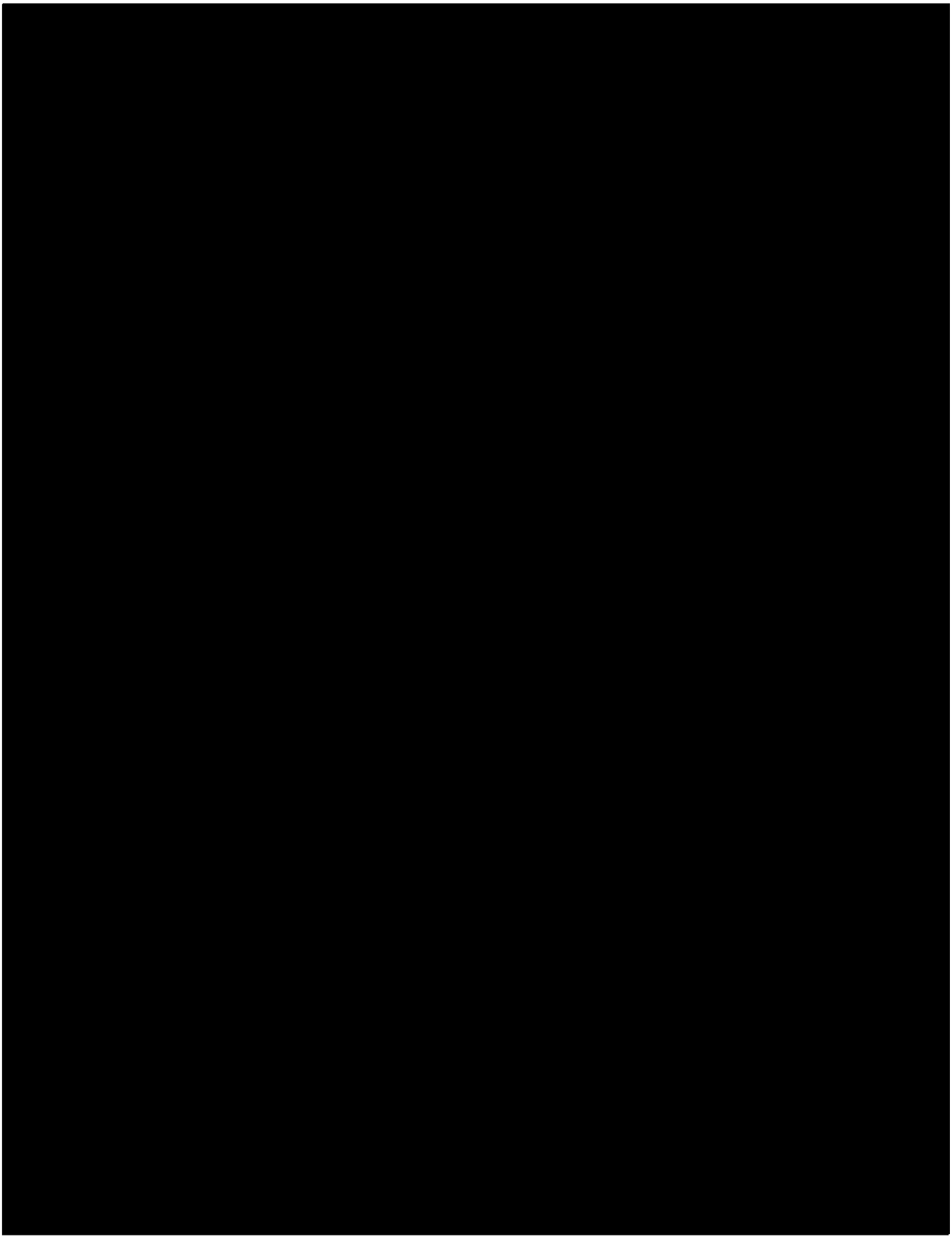
The optimization goal here is motivated by the fact that the surplus-maximizing bid in a second price auction is $b = v$. Another way of stating this is that we interpret the advertiser's bid as a bid into a second price auction and adjust the bid in non-second-price auctions to optimize for the same quantity that a second-price auction does. As a consequence, this bid adjustment is a no-op in a pure second price auction.

Note that for now, this project is only applied to non-incremental domains in AWBid traffic (AdWords advertiser buying on external exchanges), but the approaches described should be applicable to all other non-second price auctions.

In order to learn the optimal bids, we run exploration experiments where we lower the bid using fixed multipliers to determine a landscape of volume and costs and a function of bid.







We first show the stats sliced by non-incremental domains and incremental domains. However, RASTA does not support this feature right now. So, these stats are aggregated from gTrade analysis table generated by gTrade monitoring pipeline everyday. The incremental domains are listed in txt files here and updated everyday.

Non-incremental domains

Metric	Control	Experiment	Change
impressions	951,434,290	789,548,217	-17.01%
revenue	$1,433,884	$1,077,156	-24.88%
payout	$961,406.63	$713,362.51	-25.80%
value	$1,738,630	$1,611,909	-7.29%
surplus	$777,223.53	$898,546.37	
profit	$472,477.26	$363,793.68	-23.00%

Incremental domains

Metric	Control	Experiment	Change
impressions	712,741,257	693,192,899	-2.74%
revenue	$844,233.98	$916,340.15	
payout	$891,683.84	$940,553.97	
value	$1,096,990	$1,125,661	
surplus	$205,306.43	$185,107.04	-9.84%
profit	$-47449.85	$-24213.81	

The stats of overall impact on AWBid traffic slice

Metric	Control	Experiment	Change

queries	71,006,687,028	69,882,430,912	-1.58%
impressions	1,663,358,704	1,481,943,435	-10.91%
revenue	$2,276,833.23	$1,992,217.13	-12.50%
payout	$1,851,379.41	$1,652,315.08	-10.75%
value	$2,831,255.13	$2,716,880.96	-4.04%
profit	$425,453.81	$339,902.04	-20.11%

If we only consider the no budget constrained revenue loss, the revenue drop percentage is -9.44%.
We also observed that there is some small gains on AdWords buying on Adx slice, as the stats shown below.

Metric	Control	Experiment	Change
queries	20,322,046,392	20,371,782,034	
impressions	16,295,746,754	16,342,807,036	
revenue	$13,675,805.89	$13,704,769.60	
payout	$9,624,468.41	$9,635,092.55	
value	$25,674,395.41	$25,718,707.10	
Google profit	$4,038,753.31	$4,057,160.74	
GDN profit	$1,734,347.09	$1,749,934.38	

This indicates that Marple model helps to shift some external exchange traffic back to Adx. The RASTA page for the 20% experiment is here.

CPD metrics (VBBDash)

	Changes
All VBB	
All CT	
All AWBid (RASTA)	

The model implementation and serving infrastructure changes are tested with various unit tests.

- Unit tests for Marple model python implementation.
- Unit tests for Marple serving infrastructure changes.

Marple background experiment configurations
Marple lingo code and python modeling code
Marple lingo and model borgcron jobs
Marple processed background experiment logs data
Poirot related docs

- Initial design doc
- Poirot model revision doc
- Poirot bid bucket model doc